IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
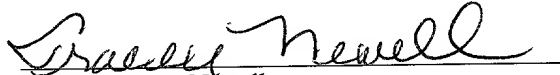
In re application of: :
    KAMVYSSELIS, Peter   :
                                               :
Application No.: To be assigned   :   Art Unit: To be assigned
                                               :
Filed: September 28, 2001   :   Examiner: To be assigned
                                               :
For: ERROR RECOVERY FOR   :   Docket No.:   EMS-02003
        SRDF ASSIST   :

Certificate of Express Mailing

I hereby certify that the foregoing documents are being deposited with the United States Postal Service as express mail, in an envelope addressed to the Commissioner for Patents Washington, D.C. 20231 on this date of September 28, 2001.

Name: Tracey Newell
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PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, entry of this amendment is respectfully requested for the above-captioned U.S. patent application.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those which may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required for consideration of this paper (including fees for net addition of claims) are authorized to be charged in two originally-executed copies of a Transmittal Letter filed herewith.

HWD2 936294v1

IN THE TITLE:

Please replace the title with:

--ERROR RECOVERY FOR SRDF ASSIST--

IN THE SPECIFICATION:

On page 1, after the title, please add:

-- Cross-Reference to Related Applications

This application is a continuation of U.S. patent application No. 09/940,903 filed on August 28, 2001 (pending).--

IN THE CLAIMS:

Please cancel Claims 1-62 without prejudice or disclaimer of the subject matter thereof.

Please add the following new Claims 63-96:

63. A method for performing data recovery in a computer system comprising:

sending data from a first storage device to at least one other secondary storage device, said data being sent in a plurality of data packets, each of said plurality of packets being associated with a sequence number having a first predetermined value;

upon determining that the data has been successfully stored on all of said at least one other storage device, deleting journal entries in a sender corresponding to said data; and

upon determining a failure in connection with synchronizing data between a first storage device and at least one other secondary storage device, deleting journal entries in each of said at least one other secondary storage device, and resending unsynchronized journal entries from the sender.

64. The method of Claim 63, further comprising:

determining at least one journal entry in said sender that is an earliest journal entry included in said sender's journal entries; and

resending data starting with data of said earliest journal entry.

65. The method of Claim 64, further comprising:

determining an age of each journal entry included in said sender using sequence numbers such that the earliest journal entry has a lowest sequence number of all journal entries included in said sender.

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66. The method of Claim 65, wherein said sender is a WAN blade coupled to said first storage device.

67. The method of Claim 66, wherein when a failure is determined, journal entries in each of said secondary storage device are determined to be unsynchronized.

68. The method of Claim 67, wherein a failure prevents a consistency group of storage devices from synchronizing data, said first storage device and said at least one other secondary storage device being included in said consistency group.

69. The method if Claim 68, wherein, upon occurrence of a failure, the consistency group triggers so that the secondary storage devices are deemed not ready by the first storage device and any subsequent updates on the first storage device are indicated as invalid on the secondary storage devices.

70. The method of Claim 69, wherein in response to said failure, data marked as invalid on the secondary devices is copied from the first to the other secondary storage devices as part of data restoration.

71. The method of Claim 63, wherein said failure is a link failure occurring when at least one communication link fails.

72. The method of Claim 71, further comprising:

    detecting a link failure by failure of a linked device to response to a direct inquiry.

73. The method of Claim 72, wherein said link failure is a failed link between two WAN blades connected by a network.

74. The method of Claim 72, wherein said link failure is a failed link between a WAN blade coupled to a primary storage device.

75. The method of Claim 74, further comprising: in response to detecting said failed link, journaling writes to the WAN blade rather than the primary storage device, said WAN blade acting as a buffer to compensate for said failed link.

76. The method of Claim 75, wherein, upon said WAN blade having a journal that overflows, said WAN blade not acknowledging write operations by the primary storage device.

77. The method of Claim 76, further comprising:

    clearing said journal on said WAN blade in response to said journal overflowing by sending messages to the primary storage device to invalidate previously written and acknowledged data.

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78. The method of Claim 63, wherein in response to the sequence number in the sender becoming equal to a second predetermined value different from the first predetermined value, acknowledging receipt of the blocks of data corresponding to the packets of data that are assigned the first predetermined value as the sequence number and sending the packets of data that are assigned the first predetermined value as the sequence number to said at least one other secondary storage device.

79. The method of Claim 78, wherein said acknowledging includes sending an acknowledgement to a host in the computer system sending data to the first storage device prior to said data actually being transferred to the at least one secondary storage device.

80. A computer program product for performing data recovery in a computer system comprising:

machine executable code that sends data from a first storage device to at least one other secondary storage device, said data being sent in a plurality of data packets, each of said plurality of packets being associated with a sequence number having a first predetermined value;

machine executable code that, upon determining that the data has been successfully stored on all of said at least one other storage device, deletes journal entries in a sender corresponding to said data; and

machine executable code that, upon determining a failure in connection with synchronizing data between a first storage device and at least one other secondary storage device, deletes journal entries in each of said at least one other secondary storage device, and resends unsynchronized journal entries from the sender.

81. The computer program product of Claim 80, further comprising:

machine executable code that determines at least one journal entry in said sender that is an earliest journal entry included in said sender's journal entries; and

machine executable code that resends data starting with data of said earliest journal entry.

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82. The computer program product of Claim 81, further comprising:

machine executable code that determines an age of each journal entry included in said sender using sequence numbers such that the earliest journal entry has a lowest sequence number of all journal entries included in said sender.

83. The computer program product of Claim 82, wherein said sender is a WAN blade coupled to said first storage device.

84. The computer program product of Claim 83, further comprising machine executable code that, when a failure is determined, determines journal entries in each of said secondary storage device to be unsynchronized.

85. The computer program product of Claim 84, further comprising machine executable code that determines failure prevents a consistency group of storage devices from synchronizing data, said first storage device and said at least one other secondary storage device being included in said consistency group.

86. The computer program product Claim 85, further comprising machine executable code that, upon occurrence of a failure, triggers a consistency group in that the secondary storage devices are deemed not ready by the first storage device and any subsequent updates on the first storage device are indicated as invalid on the secondary storage devices.

87. The computer program product of Claim 86, further comprising machine executable code that, in response to said failure, marks data as invalid on the secondary devices and copies said data from the first storage device to the secondary storage devices as part of data restoration.

88. The computer program product of Claim 80, further comprising machine executable code that determines said failure is a link failure occurring when at least one communication link fails.

89. The computer program product of Claim 88, further comprising:

machine executable code that detects a link failure by failure of a linked device to response to a direct inquiry.

90. The computer program of Claim 89, further comprising machine executable code that determines said link failure is a failed link between two WAN blades connected by a network.

91. The computer program product of Claim 89, further comprising machine executable code that determines said link failure is a failed link between a WAN blade coupled to a primary storage device.

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92. The computer program product of Claim 91, further comprising: machine executable code that, in response to detecting said failed link, journals writes to the WAN blade rather than the primary storage device, said WAN blade acting as a buffer to compensate for said failed link.

93. The computer program product of Claim 92, further comprising machine executable code that, upon said WAN blade having a journal that overflows, causes said WAN blade not to acknowledge write operations by the first storage device.

94. The computer program product of Claim 93, further comprising:

machine executable code that clears said journal on said WAN blade in response to said journal overflowing by sending messages to the primary storage device to invalidate previously written and acknowledged data.

95. The computer program product of Claim 80, further comprising machine executable code that, in response to the sequence number in the sender becoming equal to a second predetermined value different from the first predetermined value, acknowledges receipt of the blocks of data corresponding to the packets of data that are assigned the first predetermined value as the sequence number and sending the packets of data that are assigned the first predetermined value as the sequence number to said at least one other secondary storage device.

96. The computer program product of Claim 95, wherein said machine executable code that acknowledges includes machine executable code that sends an acknowledgement to a host in the computer system sending data to the first storage device prior to said data actually being transferred to the at least one secondary storage device.

REMARKS

Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-951-6676.

Respectfully submitted,
HUTCHINS, WHEELER & DITTMAR

Date: September 28, 2001

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